

ON THE FRONT OF YOUR BLUEBOOK write: (1) your name, (2) your student ID number, (3) lecture section (4) your instructor's name, and (5) a grading table. You must work all of the problems on the exam. Show ALL of your work in your bluebook and **BOX IN YOUR FINAL ANSWERS**. A correct answer with no relevant work may receive no credit, while an incorrect answer accompanied by some correct work may receive partial credit. Text books, class notes, and calculators are NOT permitted.

1. (20 points) Evaluate df/dx for the following functions.

- (a) $f(x) = \ln(\cosh x)$
- (b) $f(x) = \cosh(\ln x)$
- (c) $f(x) = x \operatorname{sech}^{-1}(x) - \cos^{-1}(x)$
- (d) $f(x) = x^x$

2. (15 points) Evaluate the following integrals.

- (a) $\int_0^4 \frac{2t}{t^2 - 25} dt$
- (b) $\int_{-1/5}^{1/5} \frac{6dx}{\sqrt{4 - 25x^2}}$
- (c) $\int_1^2 \frac{8dx}{x^2 - 2x + 2}$

3. (15 points) Consider the differential equation $\frac{dy}{dt} = \frac{2t^2 + 1}{te^y}$ for $t > 0$.

- (a) Find the general solution of the differential equation.
- (b) Find the particular solution to the differential equation in part (a) if $y(1) = 0$.

4. (20 points) Consider the region bounded above by the curve $y = \sqrt{x} + 1$, below by $y = 0$, and on the right by $x = 4$, and on the left by $x = 0$.

- (a) Find the volume of the solid if the region is revolved around the x-axis.
- (b) Set up, but **do not** evaluate the integral to find the volume of the solid if the region is revolved around the line $y = 4$.
- (c) **Using the shell method**, find the volume of the solid if the region is revolved around the y-axis.

5. (15 points) A rod of length 4 has varying density given by the equation $\delta(x) = \sqrt{x}$ for $0 \leq x \leq 4$.

- (a) Find the mass of the rod.
- (b) Find the center of mass of the rod.

6. (15 points) Determine the length of the curve defined by the function

$$y(x) = \int_0^x \sqrt{t^2 + 6t + 8} dt$$

from $x = 0$ to $x = 4$.